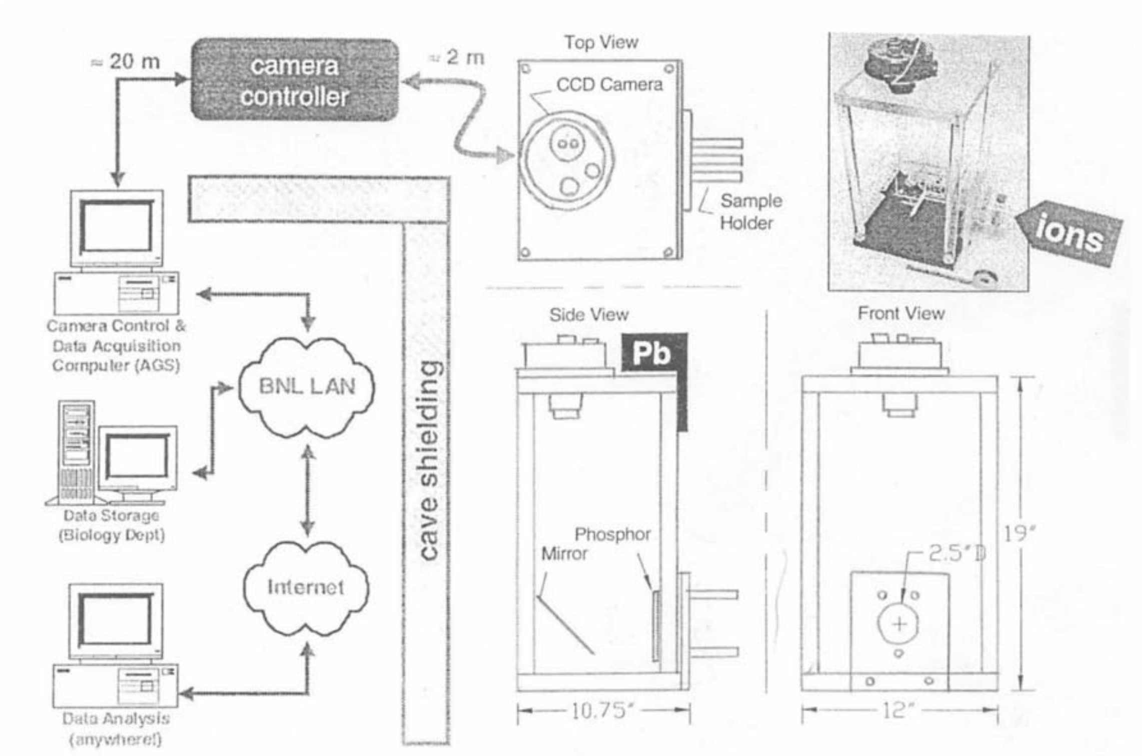
U.S. Department of Energy
Brookhaven National Laboratory
Pollution Prevention Fact Sheet

Pollution Prevention Project Proposal

Title: Installation of an Integrating Ion Imager system in the Building 958 for recording spatial distribution of the dose of heavy ions and for the precision positioning and beam delivery on samples



The Integrating Ion Imager system will be located in Bldg. 958 and used to record the spatial distribution of the dose of heavy ions incident on samples irradiated at the NSRL radiobiology beamline of the Collider Accelerator at Brookhaven National Laboratory. This camera will provide real time photographic imaging and computer interfacing of the various projects that are being researched in the NSRL. Some of the non-financial benefits of the I3 include:

- More accurate measurement of the spatial distribution from the detectors. With x-ray film the standard practice was to expose film prior to each experiment to insure beam uniformity – this presumes there will be no significant variation in the radiation field.
- Electronic based detectors as the response (optical density of the negative) are a more linear function of the fluence that exposed it and has a much broader dynamic range.
- The distribution of ion flux of each individual irradiation can be recorded and stored.
- A digital image can be viewed within seconds of exposure minimizing errors in beamline configuration and maximizing beamline time, thus preventing the loss of many samples or even a complete experiment.
- The image produced may be used to determine the absorbed dose at each point in the target cross-section.
- Data can be retrieved over the local area network or the internet for subsequent analysis.

Current imaging capabilities of the NSRL rely on standard wet chemistry photographic processes. These processes utilize toxic chemicals and result in generation of hazardous waste (estimated at 440 gallons/year). Use of traditional photographic methods is labor intensive and requires a dedicated and maintained photographic darkroom. Additionally, generation and accumulation of hazardous waste and contaminated rinse waters is highly regulated and subjects the Laboratory to potential violations. The digital imaging technology proposed eliminates all these problems, while enhancing our scientific capabilities.

There is a Laboratory initiative to make more user-friendly facilities. This camera will allow the C-A, Medical and Biology Departments to initiate a "Laboratory without walls" approach to research and interface the camera with the internet to allow a sponsor/researcher to participate in their investigation in "real time"

Benefits-at-a-Glance

- Eliminates ____440____ gallons of hazardous waste per year;
- Saves over $133,704.50 annually from reduced waste, reduced labor, reduced beam time cost, and reduced material costs;
  - $20,584.50 savings waste disposal
  - $12,100.00 savings labor
  - $1,020.00 savings in material costs
  - $100,000.00 savings in beam time costs
- Eliminates the need for continued use of the NSRL darkroom and the need for a Satellite Accumulation Area and the associated regulatory requirements;

Project Title:

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Project Features:

Host Site Brookhaven National Laboratory
Host PSO Office of Science
Dept/Div Collider Accelerator Dept.
Point of Contact A. Rusek 911B, ext. 5830, rusek@bnl.gov
Benefits The procurement of the digital camera system will avoid the generation of 440 gal/yr of new photographic waste streams, reduce the chance of a spill, and reduce the potential for RCRA/SPDES violations associated with the waste streams. ***Partial P2 funding would be welcomed as this request will also be sent to NASA for additional funding.***

Project Type	Waste Minimization
Primary Wastes Avoided	Photographic wastes
Projected Annual Waste Reduction	Photographic Developing: • Chemical waste (developer D19; fixer) _20_ gallons per year; • Rinse water (contains photoflow & silver) _420_ gallons per year (this rinse is anticipated to be hazardous waste); **TOTAL:** 440 gal/year or **3665 lbs/yr of hazardous waste.** Film: **300 x-ray films/year** (municipal waste).
Projected Useful Life	Annually recurring
Requested Capital Funds	Equipment costs $ 75,000
Requested Expense Funds	0
TOTAL PROJECT COST	$75,000

Projected Annual Savings	• Film cost: @$3.40per film/one and 300 films/annually.[300 X $3.40 = $1020.00/year] • Time loading and developing film: 100 hours/ run 100 scientist hours/run X 121/hr = $12,100/run • Lost beam time during film processing: 100 hours/run X 1,000/hr = $100,000.00 • Waste Disposal Savings: 167 lbs X $18.50/lb = $3089.50 + 3499 lbs X $5.00/lb = $17,495.00 or $20,584.50/year total **SAVINGS [YEARLY]:** **$133,704.50/year**
PAYBACK PERIOD	About 5 months
Non-financial Benefits	• More accurate measurement of the spatial distribution from the detectors. With x-ray film the standard practice was to expose film prior to each experiment to insure beam uniformity – this presumes there will be no significant variation in the radiation field. • Electronic based detectors as the response (optical density of the negative) are a more linear function of the fluence that exposed it and has a much broader dynamic range. • The distribution of ion flux of each individual irradiation can be recorded and stored. • A digital image can be viewed within seconds of exposure minimizing errors in beamline configuration and maximizing beamline time, thus preventing the loss of many samples or even a complete experiment. • The image produced may be used to determine the absorbed dose at each point in the target cross-section. • Data can be retrieved over the local area network or the internet for subsequent analysis.
Regulatory Drivers	RCRA Pollution Prevention Requirements, DOE order, “Greening the Government”.
Critical Outcomes	The NASA Space Radiation Laboratory in buildings 956-958 is currently supporting work for three Departments – Collider Accelerator, Medical and Biology covering two Directorates at the laboratory.
Implementation Schedule	180 days after funding is approved

Potential for Broader Application:

The use of the Integrating Ion Imager will allow NASA researchers to have a “Laboratory without walls” approach to research. The camera can then be interfaced with the internet to allow a sponsor or researcher to participate in their investigation in “real time”. Additionally, it will allow the investigator the latitude to take as many photomicrograghs as are needed to document phenomena, without concerns of mixed waste disposal and excessive development and film loading times.